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(54) **ILLUMINATION APPARATUS**

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F21V 9/10	(2006.01)
F21K 99/00	(2016.01)
F21S 8/10	(2006.01)
F21Y 101/02	(2006.01)

(52) **U.S. Cl.**

CPC ***F21V 13/08*** (2013.01); ***F21K 9/56*** (2013.01); ***F21K 9/58*** (2013.01); ***F21S 48/1145*** (2013.01); ***F21S 48/1388*** (2013.01); ***F21S 48/1757*** (2013.01); ***F21V 9/10*** (2013.01); ***F21V 14/04*** (2013.01); *F21Y 2101/025* (2013.01)

(58) **Field of Classification Search**

CPC F21V 13/08; F21V 9/10; F21V 14/04; F21S 48/1388

See application file for complete search history.

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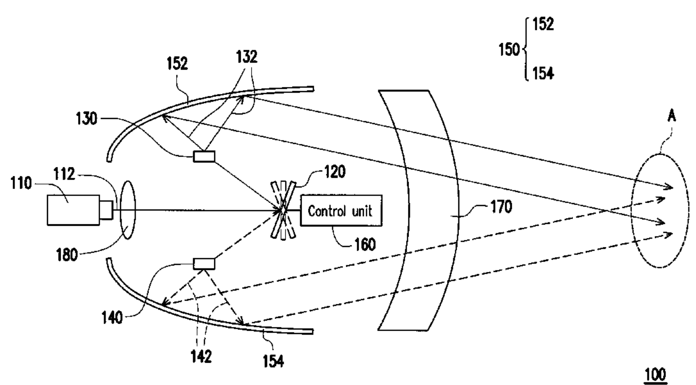
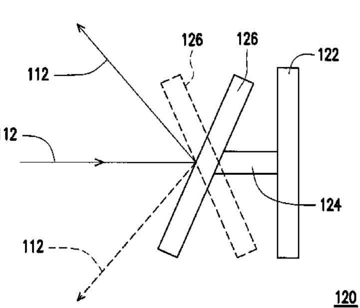
(57) **ABSTRACT**

An illumination apparatus including an exciting light source, a reflective switching element, a first wavelength conversion element, and a second wavelength conversion element is provided. The exciting light source emits an exciting beam, and the reflective switching element is disposed on a transmission path of the exciting beam. When the reflective switching element is switched to a first state, the reflective switching element reflects the exciting beam to the first wavelength conversion element so as to excite the first wavelength conversion element to emit a first conversion beam. When the reflective switching element is switched to a second state, the reflective switching element reflects the exciting beam to the second wavelength conversion element so as to excite the second wavelength conversion element to emit a second conversion beam.

13 Claims, 3 Drawing Sheets





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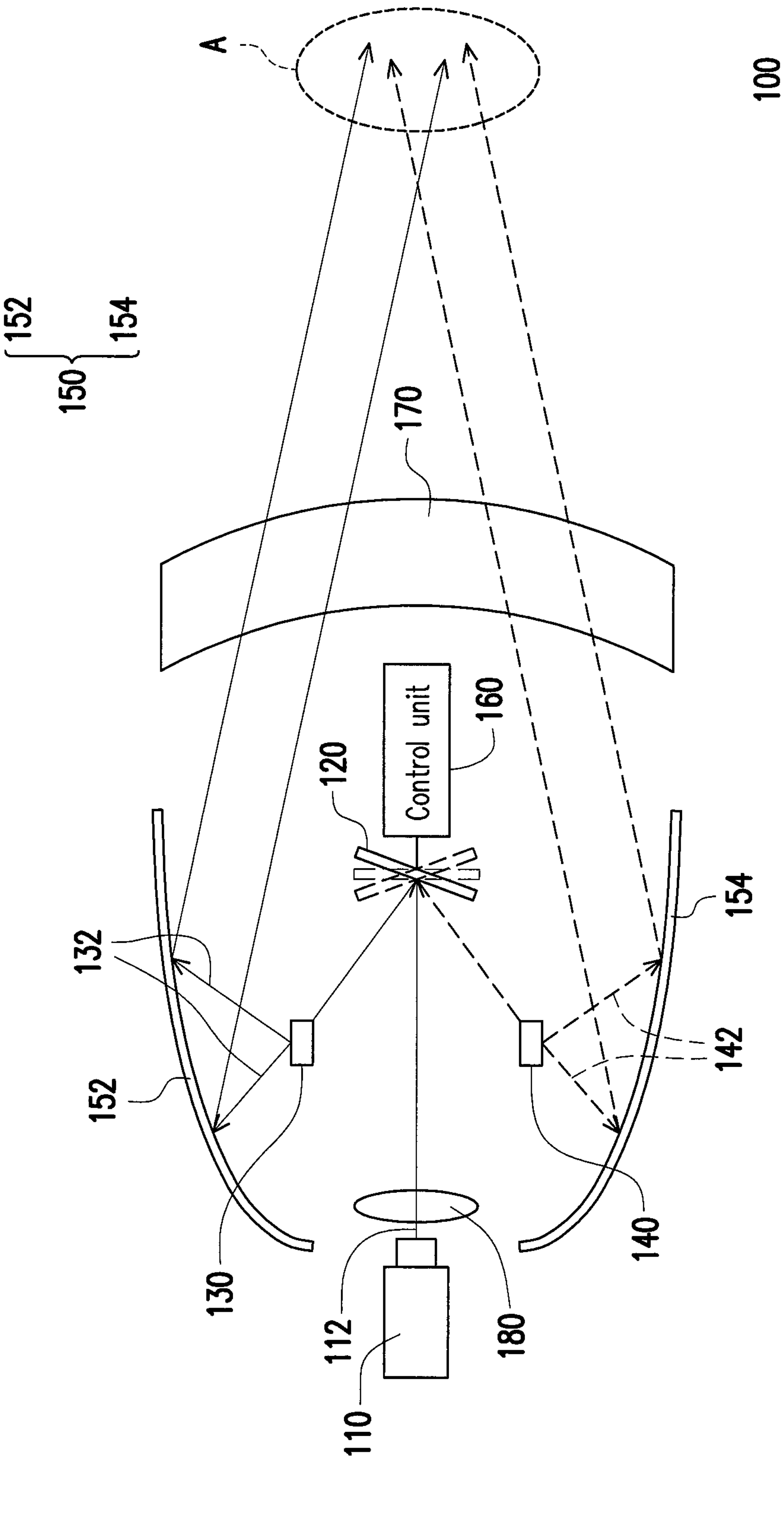
A
100
152
154
150
170
Control unit
160
120
132
152
154
142
142
130
140
112
180
110

FIG. 1A

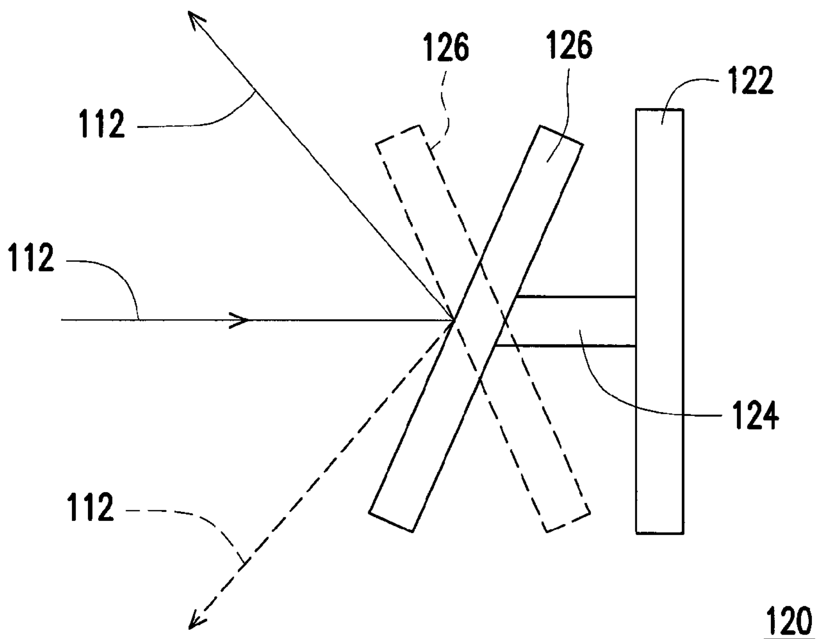
112
112
112
126
126
122
124
120

FIG. 1B

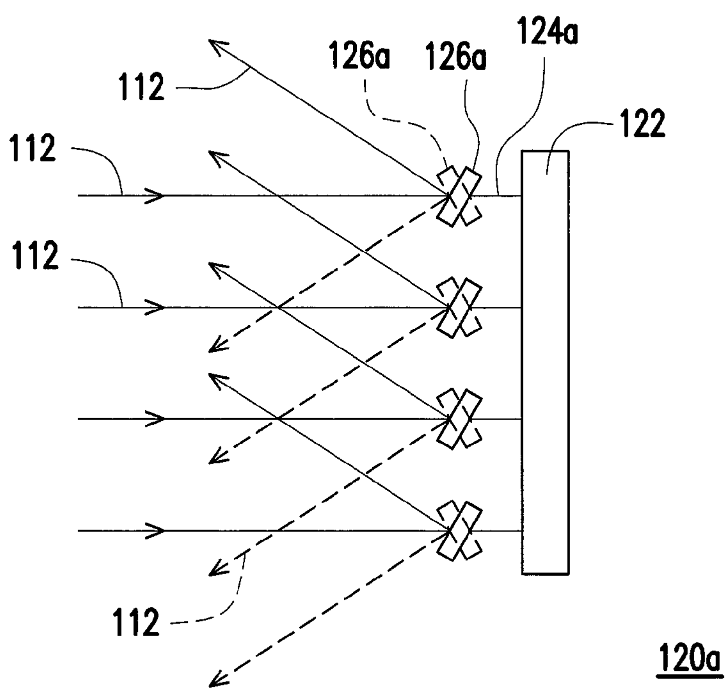
112
112
112
112
126a
126a
124a
122
120a

FIG. 2

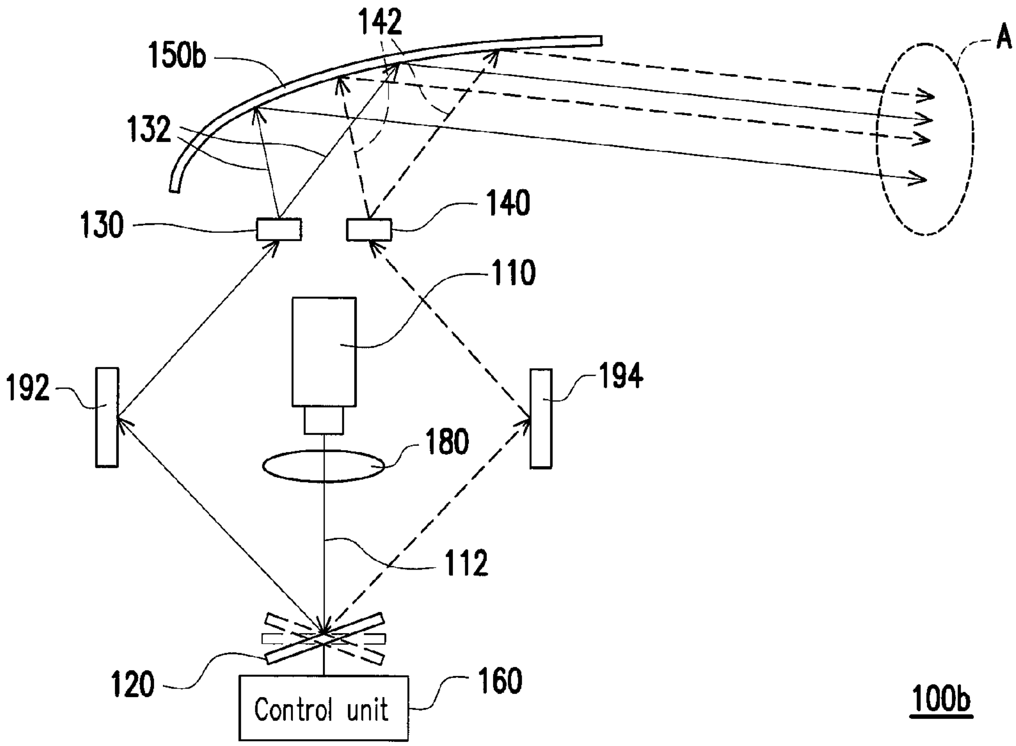
142
150b
A
132
130
140
110
192
194
180
112
120
160
Control unit
100b

FIG. 3

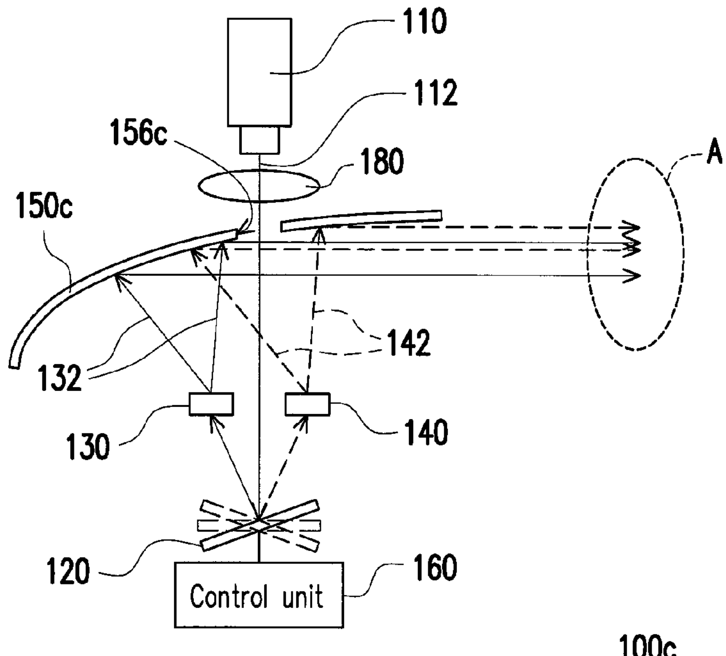
110
112
156c
180
A
150c
142
132
130
140
120
160
Control unit
100c

FIG. 4

ILLUMINATION APPARATUS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the priority benefit of Taiwan application serial no. 103120583, filed on Jun. 13, 2014. The entirety of the above-mentioned patent application is hereby incorporated by reference herein and made a part of this specification.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention is related to an illumination apparatus, and more particularly to a laser illumination apparatus.

2. Description of Related Art

As technologies advance and more attention has been paid to environmental protection, the structure of a light source apparatus has evolved. For example, in recent years, headlights for vehicles with mainly solid state light source such as light emitting diode and laser diode have been increasingly developed in the market. The illumination efficiency of the light emitting diode is about 5% to 8% and has different color temperatures for selection with excellent power saving benefit. Since the laser diode has more than 20% of illumination efficiency, to deal with the limitation to the light source of the light emitting diode, a technique that utilizes laser light source to excite phosphor to generate applicable high efficiency light source has been gradually developed. The above two styles are current main streams of the light source for solid state illumination.

The technique that utilizes laser light source to excite the phosphor to emit light also has an advantage that the amount of the light source may be flexibly adjusted to achieve different headlight illuminance requirements. Therefore, the method is significantly potential under the structure of a headlight light source module, and is very likely to replace conventional high pressure mercury lamps in the future to become the light source of new main stream headlight illumination.

US patent publication No. 20110249460 discloses a vehicle headlight. U.S. Pat. No. 8,439,537 discloses a lighting fixture unit. US patent publication No. 20130027962 discloses a headlight system.

SUMMARY OF THE INVENTION

The invention provides an illumination apparatus which has a simple structure and may adjust the ratio of different conversion beams.

The objectives and advantages of the invention may be further understood in the technical features disclosed in the invention.

To achieve one or a part or all the objectives or other objectives, an embodiment of the invention provides an illumination apparatus, including an exciting light source, a reflective switching element, a first wavelength conversion element and a second wavelength conversion element. The exciting light source emits an exciting beam, and the reflective switching element is disposed on a transmission path of the exciting beam. When the reflective switching element is switched to a first state, the reflective switching element reflects the exciting beam to the first wavelength conversion element so as to excite the first wavelength conversion element to emit a first conversion beam. When the reflective switching element is switched to a second state, the reflective switching element reflects the exciting beam to the second wavelength conversion element so as to excite the second wavelength conversion element to emit a second conversion beam.

In an embodiment of the invention, the first wavelength conversion element and the second wavelength conversion element respectively include phosphors, and the concentration of the phosphor contained in the first wavelength conversion element is different from that contained in the second wavelength conversion element.

In an embodiment of the invention, the first wavelength conversion element and the second wavelength conversion element respectively include phosphors with different materials.

In an embodiment of the invention, the illumination apparatus further includes a reflective cover reflecting at least one of the first conversion beam and the second conversion beam.

In an embodiment of the invention, the reflective cover includes a first sub-reflective cover and a second sub-reflective cover. The first sub-reflective cover reflects the first conversion beam, and the second sub-reflective cover reflects the second conversion beam. After being reflected, the first conversion beam and the second conversion beam converge in a target region.

In an embodiment of the invention, the first wavelength conversion element is disposed approximately at a focus of the first sub-reflective cover, and the second wavelength conversion element is disposed approximately at a focus of the second sub-reflective cover.

In an embodiment of the invention, the illumination apparatus further includes a first reflector and a second reflector. When the reflective switching element is switched to the first state, the reflective switching element reflects the exciting beam to the first reflector, and the first reflector reflects the exciting beam to the first wavelength conversion element. When the reflective switching element is switched to the second state, the reflective switching element reflects the exciting beam to the second reflector, and the second reflector reflects the exciting beam to the second wavelength conversion element.

In an embodiment of the invention, the first wavelength conversion element and the second wavelength conversion element are disposed approximately at a focus of the reflective cover.

In an embodiment of the invention, the reflective switching element, the first wavelength conversion element and the second wavelength conversion element are disposed approximately at the focus of the reflective cover.

In an embodiment of the invention, the reflective cover has an opening, and the exciting beam from the exiting light source is transmitted to the reflective switching element via the opening.

In an embodiment of the invention, the illumination apparatus further includes a control unit electrically connected to the reflective switching element to control a ratio of a period in which the reflective switching element is switched to the first state to a period in which the reflective switching element is switched to the second state.

In an embodiment of the invention, the exciting light source is a laser light source.

In an embodiment of the invention, the reflective switching element is a micro-electromechanical system (MEMS) reflective mirror or an MEMS reflective mirror array.

In an embodiment of the invention, the illumination apparatus further includes a light transmissive cover disposed on the transmission paths of the first conversion beam and the second conversion beam from the reflective cover.

The embodiments of the invention may achieve at least one of the following advantages or effects. In the embodiments of the invention, since the illumination apparatus adopts the reflective switching element that may be switched to the first state and the second state, a ratio of the first conversion beam to the second conversion beam may be adjusted under a simple structure.

Other objectives, features and advantages of the invention will be further understood from the further technological features disclosed by the embodiments of the invention wherein there are shown and described preferred embodiments of this invention, simply by way of illustration of modes best suited to carry out the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings are included to provide a further understanding of the invention, and are incorporated in and constitute a part of this specification. The drawings illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

FIG. **1**A is a schematic view illustrating a structure of an illumination apparatus according to an embodiment of the invention.

FIG. **1**B is a schematic view illustrating a structure of a reflective switching element of FIG. **1**A.

FIG. **2** shows a variation of the reflective switching element of FIG. **1**B.

FIG. **3** is a schematic view illustrating a structure of an illumination apparatus according to another embodiment of the invention.

FIG. **4** is a schematic view illustrating a structure of an illumination apparatus according to another embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings which form a part hereof, and in which are shown by way of illustration specific embodiments in which the invention may be practiced. In this regard, directional terminology, such as "top," "bottom," "front," "back," etc., is used with reference to the orientation of the Figure(s) being described. The components of the invention can be positioned in a number of different orientations. As such, the directional terminology is used for purposes of illustration and is in no way limiting. On the other hand, the drawings are only schematic and the sizes of components may be exaggerated for clarity. It is to be understood that other embodiments may be utilized and structural changes may be made without departing from the scope of the invention. Also, it is to be understood that the phraseology and terminology used herein are for the purpose of description and should not be regarded as limiting. The use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms "connected," "coupled," and "mounted" and variations thereof herein are used broadly and encompass direct and indirect connections, couplings, and mountings. Similarly, the terms "facing," "faces" and variations thereof herein are used broadly and encompass direct and indirect facing, and "adjacent to" and variations thereof herein are used broadly and encompass directly and indirectly "adjacent to". Therefore, the description of "A" component facing "B" component herein may contain the situations that "A" component directly faces "B" component or one or more additional components are between "A" component and "B" component. Also, the description of "A" component "adjacent to" "B" component herein may contain the situations that "A" component is directly "adjacent to" "B" component or one or more additional components are between "A" component and "B" component. Accordingly, the drawings and descriptions will be regarded as illustrative in nature and not as restrictive.

FIG. **1**A is a schematic view illustrating a structure of an illumination apparatus according to an embodiment of the invention. FIG. **1**B is a schematic view illustrating a structure of a reflective switching element of FIG. **1**A. Please refer to FIGS. **1**A and **1**B. An illumination apparatus **100** of the embodiment includes an exciting light source **110**, a reflective switching element **120**, a first wavelength conversion element **130** and a second wavelength conversion element **140**. The exciting light source **110** emits an exciting beam **112**. In the embodiment, the exciting light source **110** is a laser light source. For example, the exciting light source **110** may include a single laser diode or a plurality of laser diodes arranged in an array; the exciting beam **112** is, for example, a laser beam. In addition, in the embodiment, the first wavelength conversion element **130** and the second wavelength conversion element **140** respectively include phosphors, and the concentration of the phosphor contained in the first wavelength conversion element **130** is different from that contained in the second wavelength conversion element **140**.

The reflective switching element **120** is disposed on a transmission path of the exciting beam **112**. When the reflective switching element **120** is switched to a first state (i.e. the solid line state shown in FIGS. **1**A and **1**B, i.e. a reflective mirror **126** of FIG. **1**B has an angle indicated by the solid lines), the reflective switching element **120** (i.e. the reflective mirror **126**) reflects the exciting beam **112** to the first wavelength conversion element **130** to excite the first wavelength conversion element **130** to emit a first conversion beam **132**. When the reflective switching element **120** is switched to a second state (i.e. the dash line state shown in FIGS. **1**A and **1**B, i.e. the reflective mirror **126** of FIG. **1**B has an angle indicated by the dash lines), the reflective switching element **120** reflects the exciting beam **112** to the second wavelength conversion element **140** to excite the second wavelength conversion element **140** to emit a second conversion beam **142**.

For example, the exciting beam **112** is, for instance, a blue beam; the first wavelength conversion element **130** and the second wavelength conversion element **140** respectively include yellow phosphors with different concentration. In the embodiment, the concentration of the yellow phosphor contained in the first wavelength conversion element **130** is less than the concentration of the yellow phosphor contained in the second wavelength conversion element **140**. Therefore, the first wavelength conversion element **130** converts a portion of the exciting beam **112** into a yellow beam, and the portion of the exciting beam **112** not being converted by the first wavelength conversion element **130** remains in the form of blue beam and is transmitted through the first wavelength conversion element **130**. In addition, the portion of the exciting beam **112** not being converted by the first wavelength element **130** and the first conversion beam **132** are mixed to form a white beam.

On the other hand, the second wavelength conversion element **140** converts at least a portion of the exciting beam **112** into a yellow beam, and the portion of the exiting beam **112** not being converted by the second wavelength conversion element **140** remains in the form of blue beam and is transmitted through the second wavelength conversion element **140**. Moreover, the portion of the exciting beam **112** not being converted by the second wavelength conversion element **140** and the second conversion beam **142** are mixed to form a white beam.

Since the concentration of the yellow phosphor contained in the first wavelength conversion element **130** is less than the concentration of the yellow phosphor contained in the second wavelength conversion element **140**, the yellow color constituent in the white beam mixed by the exciting beam **112** from the first wavelength conversion element **130** and the first conversion beam **132** is less than the yellow color constituent in the white beam mixed by the exciting beam **112** from the second wavelength conversion element **140** and the second conversion beam **142**. In other words, the color temperature of the white beam from the first wavelength conversion element **130** is higher than the color temperature of the white beam from the second wavelength conversion element **140**. Besides, the reflective switching element **120** may be switched rapidly to the first state and the second state; by adjusting a ratio of a period during which the reflective switching element **120** is in the first state to a period during which the reflective switching element **120** is in the second state in a unit time, the color temperature of the white beam emitted by the illumination apparatus **100** may be adjusted.

In another embodiment, the first wavelength conversion element **130** and the second wavelength conversion element **140** respectively include phosphors with different materials. For example, the first wavelength conversion element **130** and the second wavelength conversion element **140** may emit different colors of the first conversion beam **132** and the second conversion beam **142** after being excited by the exciting beam **112**. By adjusting a ratio of the period during which the reflective switching element **120** is in the first state to the period during which the reflective switching element is in the second state in a unit time, the color of the beam emitted by the illumination apparatus **100** may be adjusted.

In addition, when the concentration of the phosphor contained in the first wavelength conversion element **130** is so high that the exciting beam **112** can be completely absorbed, the light from the first wavelength conversion element **130** has the first conversion beam **132** only. However, when the concentration of the phosphor contained in the first wavelength conversion element **130** is insufficient for the exciting beam **112** to be completely absorbed by the first wavelength conversion element **130**, a portion of the exciting beam **112** will be transmitted through the first wavelength conversion element **130** and be mixed with the first conversion beam **132**. Likewise, when the concentration of the phosphor contained in the second wavelength conversion element **140** is so high that the exciting beam **112** can be completely absorbed, the light from the second wavelength conversion element **140** has the second conversion beam **142** only. However, when the concentration of the phosphor contained in the second wavelength conversion element **140** is insufficient for the exciting beam **112** to be completely absorbed by the second wavelength conversion element **140**, a portion of the exciting beam **112** will be transmitted through the second wavelength conversion element **140** and be mixed with the second conversion beam **142**.

The reflective switching element **120** is, for example, a micro-electromechanical system reflective mirror (as shown in FIG. **1**B) that includes a base **122**, a reflective mirror **126**, and a connecting portion **124** that connects the base **122** and the reflective mirror **126**. By applying voltage to cause electrostatistic attraction or repulsive force due to different polarities to be generated between the base **122** (such as the electrode on the base, not shown) and the reflective mirror **126**, the reflective mirror **126** may swing between the first state and the second state and have different angles. In the embodiment, in the first state the reflective mirror **126** tilts by +10 degrees; in the second state the reflective mirror **126** tilts by −10 degrees, which should not be construed as a limitation to the invention.

In another embodiment, the reflective switching element **120** of FIGS. **1**A and **1**B is replaced by a reflective switching element **120***a* of FIG. **2**; please see FIGS. **1**A and **2**. In FIG. **2**, the reflective switching element **120***a* is a micro-electromechanical system reflective mirror array which has a plurality of reflective mirrors **126***a* arranged in an array and a plurality of connecting portions **124***a* connecting the reflective mirrors **126***a* to the base **122**. These reflective mirrors **126***a* may be switched between the first state and the second state. When the reflective mirrors **126***a* are switched to the first state, the reflective mirrors **126***a* reflect the exciting beam **112** generated by the exciting light source **110** to the first wavelength conversion element **130**. When the reflective mirrors **126***a* are switched to the second state, the reflective mirrors **126***a* reflect the exciting beam **112** generated by the exciting light source **110** to the second wavelength conversion element **140**. Accordingly, the reflective switching element **120***a* may achieve the effect of the reflective switching element **120**. The reflective switching element **120***a* may also be a digital micro-mirror device. Alternatively, the reflective switching element **120***a* may be a micro-electromechanical system having less amount of pixels than a conventional digital micro-mirror device, which utilizes static electricity to control the reflective mirror **126***a* to deflect to the first state and the second state based on the same principle as that adopted by the digital micro-mirror device that controls the micro-reflective mirror to deflect to different angles. The difference lies in that the reflective mirror **126***a* has larger area than the micro-reflective mirror of the conventional digital micro-mirror device, and the amount of the reflective mirror **126***a* is fewer than the amount of the micro-reflective mirror of the conventional digital micro-mirror device. In addition, the principle based on which the reflective switching element **120** switches the reflective mirror **126** is the same as the principle based on which the digital micro-mirror element switches the micro-reflective mirror.

The illumination apparatus **100** may further include a reflective cover **150** reflecting at least one of the first conversion beam **132** and the second conversion beam **142**. In the embodiment, the reflective cover **150** may reflect the first conversion beam **132**, the second conversion beam **142** and the exiting beam **112** not being converted (in the case where a portion of the exciting beam **112** is not converted).

In the embodiment, the reflective cover **150** includes a first sub-reflective cover **152** and a second sub-reflective cover **154**. The first sub-reflective cover **152** reflects a first conversion beam **132**, and the second sub-reflective cover **154** reflects the second conversion beam **142**; after being reflected, the first conversion beam **132** and the second conversion beam **142** converge in a target region A. When a portion of the exciting beam **112** is not converted, the first conversion beam **132**, the second conversion beam **142** and the exciting beam **112** not being converted converge in the target region A.

In the embodiment, the illumination apparatus **100** further includes a control unit **160** electrically connected to the reflective switching element **120** to control the ratio of the period in which the reflective switching element **120** is switched to the first state to the period in which the reflective switching element **120** is switched to the second state. In other words, the color temperature or color of the beam emitted by the illumination apparatus **100** may be controlled by the control unit **160**. The control unit **160** may use hardware (such as a digital logic circuit), software or firmware to control the reflective switching element **120**.

In the embodiment, the first wavelength conversion element **130** is disposed approximately at a focus of the first sub-reflective cover **152**, and the second wavelength conversion element **140** is disposed approximately at a focus of the second sub-reflective cover **154**. In the embodiment, the first sub-reflective cover **152** and the second sub-reflective cover **154** are, for example, an ellipsoid reflective cover that allows the first conversion beam **132**, the second conversion beam **142** and the exciting beam **112** not being converted to converge in the target region A. However, in other embodiments, the first sub-reflective cover **152** and the second sub-reflective cover **154** may also be a paraboloid reflective cover, a free-form surface reflective cover or a reflective cover having other suitable shapes.

In the embodiment, the illumination apparatus **100** utilizes the reflective switching element **120** that may be switched to the first state and the second state, and therefore the ratio of the first conversion beam **132** to the second conversion beam **142** may be adjusted under a simple structure, thereby achieving the adjustment to the light-emitting color temperature or light-emitting color. When the exciting light source **110** includes only one laser generating element (such as laser diode), the illumination apparatus **100** may still achieve the adjustment to the light-emitting color temperature or light-emitting color. If the illuminating apparatus **100** is to be applied in a high-luminance area, the exciting light source **110** may include a plurality of laser generating elements, and the amount of the laser generating elements may vary depending on the requirements. Furthermore, the illumination apparatus **100** of the embodiment may not use a combiner for combining a plurality of laser beams to the phosphor and therefore does not have the following drawbacks, including having a overly-large size, requiring high alignment accuracy, and that the combiner is likely to be over-heated to cause it difficult for the heat to be dissipated, leading to poor conversion rate of the phosphor and so on.

In the embodiment, a collimating lens **180** or a set of collimating lens may be disposed on the transmission path of the exciting beam **112** from the exciting light source **110** so the exciting beam **112** can be emitted toward the reflective switching element **120** in a collimated manner. In addition, in the embodiment, the illumination apparatus **100** further includes a light transmissive cover **170** disposed on the transmission paths of the first conversion beam **132** and the second conversion beam **142** from the reflective cover **150**. Alternatively, when the exciting beam **112** is not completely absorbed, the light transmissive cover **170** may be disposed on the transmission path of the exciting beam **112**. In the embodiment, the illumination apparatus **100** may be used as an illumination apparatus for vehicles such as a headlight, and the light transmissive cover **170** may be a light cover of the headlight. In addition, the target region A is, for example, an area with a road surface, a car in front, a building, an obstacle on the road.

FIG. **3** is a schematic view illustrating a structure of an illumination apparatus according to another embodiment of the invention. Please refer to FIG. **3**. In the embodiment, an illumination apparatus **100*b*** is similar to the illumination apparatus **100** of FIG. **1**A; the main differences are described below. In the embodiment, the illumination apparatus **100*b*** further includes a first reflector **192** and a second reflector **194**. When the reflective switching element **120** is switched to the first state, the reflective switching element **120** reflects the exciting beam **112** to the first reflector **192**, and the first reflector **192** reflects the exciting beam **112** to the first wavelength conversion element **130**. When the reflective switching element **120** is switched to the second state, the reflective switching element **120** reflects the exciting beam **112** to the second reflector **194**, and the second reflector **194** reflects the exciting beam **112** to the second wavelength conversion element **140**. In the embodiment, the first reflector **192** and the second reflector **194** are, for example, a reflective mirror or a reflective prism.

In addition, in the embodiment, the first wavelength conversion element **130** and the second wavelength conversion element **140** are disposed approximately at a focus of the reflective cover **150*b***. In the embodiment, the reflective cover **150*b*** is, for example, an ellipsoid reflective cover. However, in other embodiments, the reflective cover **150*b*** may also be a paraboloid reflective cover, a free-form surface reflective cover or a reflective cover having other suitable shapes.

FIG. **4** is a schematic view illustrating a structure of an illumination apparatus according to another embodiment of the invention. Please refer to FIG. **4**. In the embodiment, an illumination apparatus **100*c*** is similar to the illumination apparatus of FIG. **1**A; the main differences are described below. In the illumination apparatus **100*c*** of the embodiment, the reflective cover **150*c*** has an opening **156*c***, and the exciting beam **112** from the exciting light source **110** is transmitted to the reflective switching element **120** via the opening **156*c***. In addition, in the embodiment, the reflective switching element **120**, the first wavelength conversion element **130** and the second wavelength conversion element **140** are all disposed approximately at a focus of the reflective cover **150*c***. In the embodiment, the reflective cover **150*c*** may be an ellipsoid reflective cover. However, in other embodiments, the reflective cover **150*c*** may also be a paraboloid reflective cover, a free-form surface reflective cover or a reflective cover having other suitable shapes.

To sum up, the embodiments of the invention may achieve at least one of the following advantages or effects. In the embodiments of the invention, since the illumination apparatus adopts the reflective switching element that may be switched to the first state and the second state, the ratio of the first conversion beam to the second conversion beam may be adjusted under a simple structure, thereby adjusting the color temperature.

The foregoing description of the preferred embodiments of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form or to exemplary embodiments disclosed. Accordingly, the foregoing description should be regarded as illustrative rather than restrictive. Obviously, many modifications and variations will be apparent to practitioners skilled in this art. The embodiments are chosen and described in order to best explain the principles of the invention and its best mode practical application, thereby to enable persons skilled in the art to understand the invention for various embodiments and with various modifications as are suited to the particular use or implementation contemplated. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents in which all terms are meant in their broadest reasonable sense unless otherwise indicated. Therefore, the term "the invention" or the like does not necessarily limit the claim scope to a specific embodiment, and the reference to particularly preferred exemplary embodiments of the invention does not imply a limitation on the invention, and no such limitation is to be inferred. The invention is limited only by the spirit and scope of the appended claims. Moreover, these claims may refer to use "first", "second", etc. following with noun or element. Such terms should be understood as a nomenclature and should not be construed as giving the limitation on the number of the elements modified by such nomenclature unless specific number has been given. The abstract of the invention is provided to comply with the rules requiring an abstract, which will allow a searcher to quickly ascertain the subject matter of the technical invention of any patent issued from this invention. It is submitted with the understanding that it will not be used to interpret or limit the scope or meaning of the claims. Any advantages and benefits described may not apply to all embodiments of the invention. It should be appreciated that variations may be made in the embodiments described by persons skilled in the art without departing from the scope of the invention as defined by the following claims. Moreover, no element and component in the invention is intended to be dedicated to the public regardless of whether the element or component is explicitly recited in the following claims.

What is claimed is:

1. An illumination apparatus, comprising:

an exciting light source emitting an exciting beam;

a reflective switching element disposed on a transmission path of the exciting beam;

a first wavelength conversion element;

a second wavelength conversion element, wherein the reflective switching element sequentially reflects the exciting beam to the first wavelength conversion element and the second wavelength conversion element, wherein the reflective switching element reflects the exciting beam to the first wavelength conversion element to excite the first wavelength conversion element to emit a first conversion beam when the reflective switching element is switched to a first state, and the reflective switching element reflects the exciting beam to the second wavelength conversion element to excite the second wavelength conversion element to emit a second conversion beam when the reflective switching element is switched to a second state; and

a reflective cover reflecting at least one of the first conversion beam and the second conversion beam.

2. The illumination apparatus according to claim **1**, wherein the first wavelength conversion element and the second wavelength conversion element comprise phosphors, respectively, and concentration of the phosphor contained in the first wavelength conversion element is different from concentration of the phosphor contained in the second wavelength conversion element.

3. The illumination apparatus according to claim **1**, wherein the first wavelength conversion element and the second wavelength conversion element comprise phosphors of different materials, respectively.

4. The illumination apparatus according to claim **1**, wherein the reflective cover comprises:

a first sub-reflective cover reflecting the first conversion beam; and

a second sub-reflective cover reflecting the second conversion beam, wherein the first conversion beam and the second conversion beam converge in a target region after being reflected.

5. The illumination apparatus according to claim **4**, wherein the first wavelength conversion element is disposed approximately at a focus of the first sub-reflective cover, and the second wavelength conversion element is disposed approximately at a focus of the second sub-reflective cover.

6. The illumination apparatus according to claim **1**, further comprising:

a first reflector, wherein the reflective switching element reflects the exciting beam to the first reflector when the reflective switching element is switched to the first state, and the first reflector reflects the exciting beam to the first wavelength conversion element; and

a second reflector, wherein the reflective switching element reflects the exciting beam to the second reflector when the reflective switching element is switched to the second state, and the second reflector reflects the exciting beam to the second wavelength conversion element.

7. The illumination apparatus according to claim **6**, wherein the first wavelength conversion element and the second wavelength conversion element are disposed approximately at a focus of the reflective cover.

8. The illumination apparatus according to claim **1**, wherein the reflective switching element, the first wavelength conversion element and the second wavelength conversion element are all disposed approximately at a focus of the reflective cover.

9. The illumination apparatus according to claim **1**, wherein the reflective cover has an opening, and the exciting beam from the exciting light source is transmitted to the reflective switching element via the opening.

10. The illumination apparatus according to claim **1**, further comprising a control unit electrically connected to the reflective switching element to control a ratio of a period in which the reflective switching element is switched to the first state to a period in which the reflective switching element is switched to the second state.

11. The illumination apparatus according to claim **1**, wherein the exciting light source is a laser light source.

12. The illumination apparatus according to claim **1**, wherein the reflective switching element is a micro-electromechanical system reflective mirror or a micro-electromechanical system reflective mirror array.

13. The illumination apparatus according to claim **1**, further comprising a light transmissive cover disposed on transmission paths of the first conversion beam and the second conversion beam from the reflective cover.

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